

## PATENT ABSTRACTS OF JAPAN

(11)Publication number : 06-053735

(43)Date of publication of application : 25.02.1994

(51)Int.Cl.

H01Q 13/08

H01Q 1/32

H01Q 1/36

H01Q 1/48

(21)Application number : 04-205017

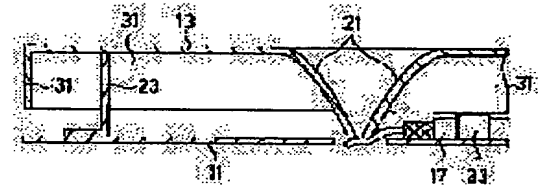
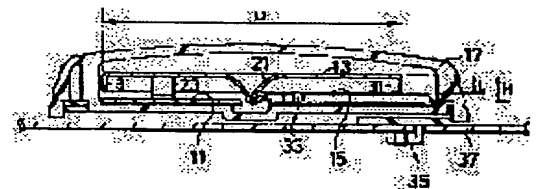
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(22)Date of filing : 31.07.1992

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## (54) PLANAR ANTENNA

(57)Abstract:

**PURPOSE:** To obtain a flat planar antenna with small size and excellent in the durability.**CONSTITUTION:** A skirt 31 is formed perpendicular to a ceiling plate 13, for example, to an end of the ceiling plate 13 of the planar antenna comprising a conductive ground plate 11, the ceiling plate 13, a feeding center pin 21 and an impedance matching pin 23. The resonance frequency of the antenna is reduced when the physical volume is the same through the forming of the skirt 31 and the physical volume of the antenna is reduced when the resonance frequency is the same thereby making the size of the antenna small. The center pin 21, the impedance matching pin 23 and a clamp 33 clamping a feeder cable are press-formed integrally with the ceiling plate 13 or the ground plate 11 thereby enhancing the strength and durability of the antenna.

## LEGAL STATUS

[Date of request for examination] 31.07.1992

[Date of sending the examiner's decision of rejection]

[Kind of final disposal of application other than the  
examiner's decision of rejection or application  
converted registration]

[Date of final disposal for application]

[Patent number] 2532800

[Date of registration] 27.06.1996

[Number of appeal against examiner's decision of  
rejection][Date of requesting appeal against examiner's decision  
of rejection]

[Date of extinction of right]

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CLAIMS

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[Claim(s)]

[Claim 1] It is the antenna which consists of a conductive cope plate and a top plate which it counters with said cope plate, and is arranged, and electric power is supplied by conductivity in a predetermined location, and is connected with a cope plate too hastily in a predetermined location, and is characterized by equipping one [ at least ] edge of a top plate or a cope plate with a skirt board.

[Claim 2] Said skirt board is an antenna according to claim 1 characterized by being arranged at right angles to either [ at least ] said top plate or a cope plate.

[Claim 3] It is the antenna which consists of impedance matching pins which short-circuit electric supply tubing, and said top plate and cope plate for supplying electric power to the predetermined location of a conductive cope plate, the conductive top plate which countered with said cope plate and has been arranged, and said top plate, and is characterized by forming said electric supply tubing and said impedance matching pin in said top plate and one.

[Claim 4] It is the antenna which is equipped with the clamp which fixes a conductive cope plate, the conductive top plate which countered with said cope plate and has been arranged, the cable for electric supply, and said cable, and is characterized by a top plate or a cope plate, and really [ said ] forming said clamp.

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## DETAILED DESCRIPTION

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### [Detailed Description of the Invention]

[0001]

[Industrial Application] This invention relates to the miniaturization of a mobile communications aerial, and the improvement technique of reinforcement and endurance especially about the antenna in the mobile communications field.

[0002]

[Description of the Prior Art] The flat antenna for the conventional land mobile radiotelephones (a tabular antenna, monotonous antenna) consisted of a top plate and a cope plate, supplied electric power to the core of a top plate, and has obtained the engine performance of an antenna by making a top plate and a cope plate short-circuit by several places. The resonance frequency of this flat antenna adjusts the appearance of a top plate and a cope plate, a short location, and short width of face, and is made in agreement with the purpose frequency.

[0003]

[Problem(s) to be Solved by the Invention] In the case of mobile communications, there is a request of wanting to make the antenna small as much as possible. However, in the conventional flat antenna, there are size of an antenna and a problem that a path must be enlarged especially as resonance frequency becomes low.

[0004] Moreover, the antenna for mobile communications tends to receive vibration and a temperature change, and reinforcement and endurance are required. However, the conventional flat antenna had many components, and there were many connection and joins, and it had the problem that reinforcement and endurance were low. It is in this invention having been made in view of the above-mentioned actual condition, and offering a small mobile communications aerial. Other purposes of this invention are to offer the flat antenna excellent in reinforcement and endurance.

[0005]

[Means for Solving the Problem] In order to attain the above-mentioned purpose, the antenna concerning the 1st viewpoint of this invention counters with a conductive cope plate and said cope plate, and is arranged, electric power is supplied by conductivity in a predetermined location, it consists of top plates connected with a cope plate too hastily in a predetermined location, and one [ at least ] edge of a top plate or a cope plate is equipped with a skirt board. Said skirt board is arranged at right angles to said top plate, for example.

[0006] In order to attain the above-mentioned purpose, the antenna concerning the 2nd viewpoint of this invention consists of impedance matching pins which short-circuit electric supply tubing, and said top plate and cope plate for supplying electric power to the predetermined location of a conductive cope plate, the conductive top plate which countered with said cope plate and has been arranged, and said top plate, and it is characterized by to form said electric supply tubing and said impedance matching pin in said top plate and one. Moreover, the clamp which fixes the cable for electric supply may a top plate or a cope plate, and really [ said ] be formed.

[0007]

[Function] According to the antenna concerning the 1st viewpoint of this invention, the skirt board is formed in the edge [ on the other hand / (generally top plate) / at least ] of a top plate or a cope plate. A skirt board has the function to reduce the resonance frequency of an antenna so that he can understand from drawing 2 . Therefore, according to the antenna concerning the 1st viewpoint of this invention, resonance frequency can be reduced as compared with the conventional antenna of the same volume, and an antenna can be miniaturized if it is the same resonance frequency as the former. The effectiveness is large, when whenever [ setting-angle / of a skirt board ] prepares a skirt board in a top plate or a cope plate below 45 degrees at a right angle since

change of a frequency is small so that he can understand from drawing 3 .

[0008] According to the antenna concerning the 2nd viewpoint of this invention, the clamp which fixes said electric supply tubing and said impedance matching pin, or the cable for electric supply is a top plate or a cope plate, and really [ said ] formed. Therefore, while the number of components of an antenna decreases as compared with the former, welding / soldering part decreases, and the reinforcement and endurance of an antenna improve.

[0009]

[Example] In advance of explanation of an example, the fundamental concept on which this invention is based is briefly explained with reference to a drawing.

[0010] Drawing 1 shows the condition of having attached the skirt board 5 in the periphery of the top plate 1 of a flat antenna which consists of a top plate (above conductor) 1, a cope plate (below conductor) 2, an impedance matching pin (ground pin) 3, and an electric supply rod (electric supply tubing) 4. Die-length [ of a skirt board 5 ] L (mm) Resonance frequency of a flat antenna (MHz) Relation is shown in drawing 2 . It is the resonance frequency (MHz) of a flat antenna as die-length [ of a skirt board 5 ] L (mm) increases so that he can understand from drawing 2 . It decreases. If it puts in another way, by forming a skirt board 5, this makes the path of a flat antenna small, maintaining resonance frequency to a predetermined value, and means that it can miniaturize.

[0011] The include angle theta of a skirt board 5 and the relation of resonance frequency are shown in drawing 3 . As shown in drawing 3 , as for the oscillation frequency of a flat antenna, an include angle theta hardly changes below 45 degrees. Therefore, as for a skirt board 5, from a viewpoint of making the volume of a flat antenna small, it is most efficient to arrange at right angles to a top plate 1. Next, the example based on the above-mentioned concept is explained with reference to drawing 4 thru/or drawing 7 .

[0012] Drawing 4 is [ the sectional view of the antenna for land mobile radiotelephones of this example and drawing 6 of the top view of the principal part of the antenna for land mobile radiotelephones of this example and drawing 5 ] the expanded sectional views of the principal part of the antenna for land mobile radiotelephones of this example. The antenna for land mobile radiotelephones shown in drawing 6 from drawing 4 is divided roughly, and consists of the cope plate 11, a top plate 13, a coaxial cable 15, and a resin case 17 ( drawing 5 ).

[0013] A cope plate 11 is formed almost disc-like by conductivity. A top plate 13 consists of conductive disks, and the center section is pressed in the shape of a cone toward a cope plate 11, and it functions as a kingpin 21 for electric supply (electric supply pin). A base material 23 is really formed in the top plate 13 with a press, and a base material 23 is bent, and the tip is \*\*\*\*\*ed to a cope plate 11, and is fixed by 25 and welding. A base material 23 achieves the function which fixes a top plate 13 to a cope plate 11, and the function as an impedance matching pin to adjust the input impedance of a flat antenna. The skirt board 31 is attached [ the top plate 13 ] in the edge of a top plate 13 at the right angle. A skirt board 31 presses the edge of a top plate 13, bends and is formed.

[0014] The coaxial cable 15 for electric supply is arranged on a cope plate 11, the central conductor is connected and fixed to a kingpin 21 with solder etc., and the mesh line is being connected and fixed to the cope plate 11 by soldering etc. A coaxial cable 15 puts slitting into a cope plate 11, and as shown in drawing 7 , through and a clamp 33 are fixed in total in the clamp 33 incurvated with a press.

[0015] The body of an antenna of the above-mentioned configuration is fixed to the plate-like resin case 17, and the resin case 17 is fixed to 37, such as a mobile, for example, the roof plate of an automobile, and a trunk, by fixing metal 35. Actuation of the flat antenna of the above-mentioned configuration is fundamentally [ as actuation of the usual flat antenna ] the same.

[0016] When a flat antenna is miniaturized, the electric volume must be maintained decreasing the apparent physical volume. As shown in drawing 5 , when the die length of H and a skirt board is set [ the path of a flat antenna ] to L for the distance of D, a top plate, and a cope plate and the electric volume of a flat antenna is set with  $V_r$  here, the electric volume  $V_r$  is  $V_r = (D+2L) \cdot \frac{\pi H}{4\lambda}$  [0017] It becomes. Therefore, the physical volume of the flat antenna of drawing 4 - drawing 6 is  $D^2$ . Although it is  $\frac{\pi H}{4}$ , for the resonance frequency, the physical volume is  $2(D+2L)$ . It becomes almost the same as that of the resonance frequency of the flat antenna of  $\frac{\pi H}{4}$ , and an antenna can be miniaturized for  $2L$  minutes.

[0018] According to the above-mentioned example, the press plastic surgery of the top plate 13 is carried out, and the base material 23 which functions as an impedance matching pin, and the kingpin 21 for electric supply are formed in a top plate 13 and one. Therefore, as compared with the case where manufacture an impedance matching pin and a kingpin separately from a top plate, and it fixes to a top plate with welding, solder, etc., while

the routing counter on manufacture is reducible, dispersion in quality is reduced, and reinforcement can be improved. Moreover, since the clamp 33 which pressed the cope plate 11 and formed the coaxial cable 15 is fixed in total, a coaxial cable 15 is certainly fixable. Moreover, since the whole antenna is covered with the resin covering 17 and it was made to fix by fixing metal 35, an antenna can be installed in the location of arbitration in the car vehicle outside.

[0019] This invention is not limited to the above-mentioned example, for example, a kingpin 21, a base material 23, a skirt board 31, and a clamp 33 may be formed by welding or soldering a pin, tubing, a metallic foil, etc. to a cope plate 11 or a top plate 13. Moreover, as shown in drawing 8, a skirt board 31 may be formed in both a top plate 13 and the cope plate 11, and also whenever [ setting-angle / of a skirt board ] is arbitrary. Moreover, a skirt board may be formed only in a cope plate 11. A kingpin 21 does not need to be a cone-like and should just choose the configuration of arbitration. Moreover, a base material 23 is not limited to two, either. In arranging for example, for a shaft about 120 degrees in arranging three base materials 23, and arranging four base materials 23, it arranges for a shaft about 90 degrees. Moreover, polygons, such as a square, a pentagon, and a hexagon, are sufficient as a top plate and a cope plate.

[0020]

[Effect of the Invention] As explained above, while being able to miniaturize a flat antenna, according to this invention, that reinforcement and endurance can be improved.

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## DESCRIPTION OF DRAWINGS

## [Brief Description of the Drawings]

[Drawing 1] It is the sectional view of the flat antenna for explaining the fundamental concept of this invention.

[Drawing 2] It is the graph which shows the die length of a skirt board and the relation of resonance frequency which are shown in drawing 1 .

[Drawing 3] It is FURAFU which shows whenever [ setting-angle / of the skirt board shown in drawing 1 ], and the relation of resonance frequency.

[Drawing 4] It is the top view of the principal part of the flat antenna concerning one example of this invention.

[Drawing 5] It is the sectional view showing the structure of a flat antenna shown in drawing 4 .

[Drawing 6] It is the expanded sectional view of the principal part of the flat antenna shown in drawing 5 .

[Drawing 7] It is drawing for explaining the clamp which fixes a coaxial cable.

[Drawing 8] It is the sectional view showing the modification of a flat antenna shown in drawing 4 .

## [Description of Notations]

1 13 [ — 5 An electric supply rod, 31 / — A skirt board, 15 / — A coaxial cable, 17 / — A resin case, 21 / — A kingpin (electric supply pin), 23 / — A base material (impedance matching pin), 25 / — It \*\*\*\*s and is 33. / — The clamp for coaxial cable immobilization, 35 / — Metallic ornaments. ] — 2 A top plate (above conductor), 11 — A cope plate (below conductor), 3 — An impedance matching pin, 4

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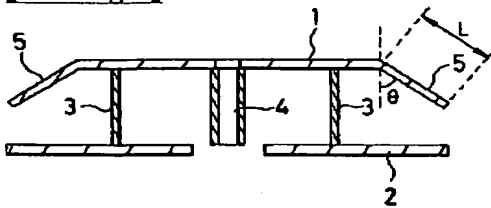
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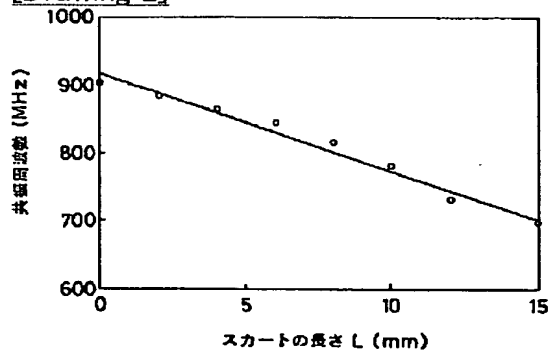
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## DRAWINGS

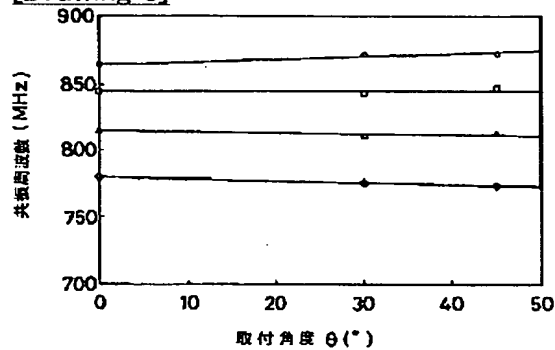
[Drawing 1]



[Drawing 2]

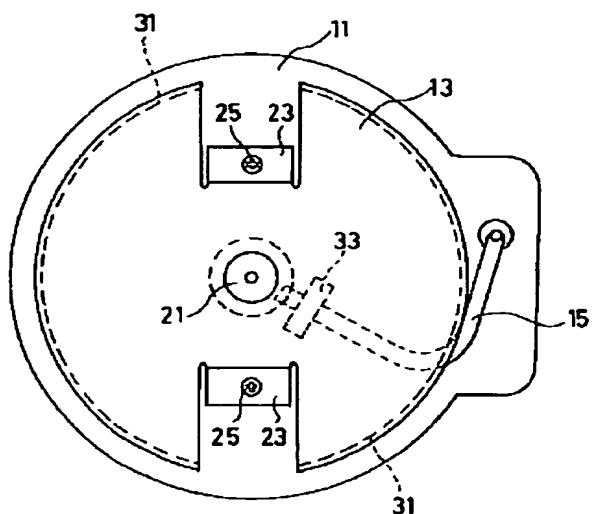


[Drawing 3]

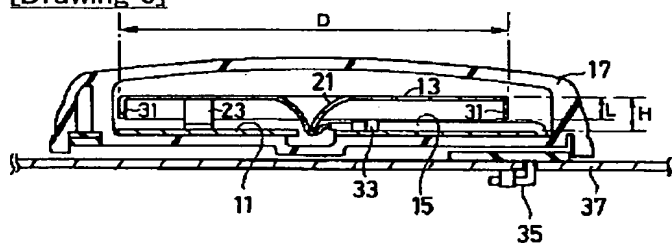


[Drawing 4]

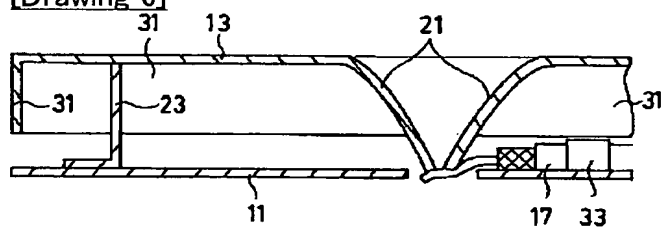




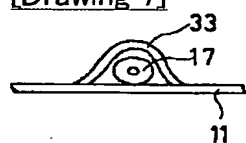
[Drawing 5]



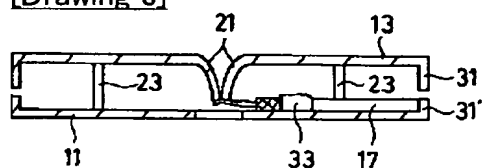
[Drawing 6]



[Drawing 7]



[Drawing 8]



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